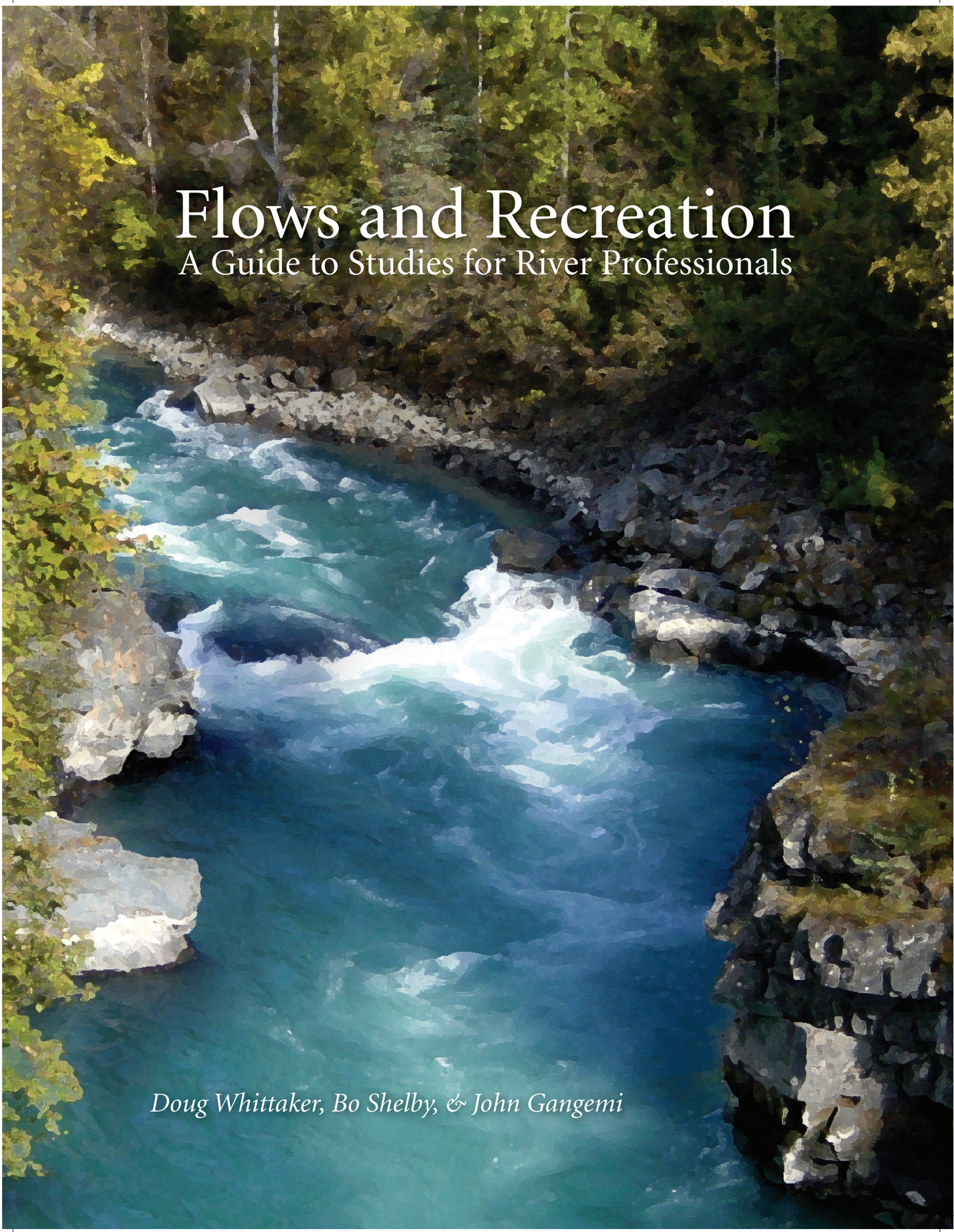

Flows and Recreation

A Guide to Studies for River Professionals

Doug Whittaker, Bo Shelby, & John Gangemi

Foreword

This guide is intended to facilitate decision-making to define flows for recreation on regulated rivers. It provides a framework and methodologies for assessing flows for recreational use. This welcome addition to the Hydropower Reform Coalition's Citizen Toolkit for Effective Participation in Hydropower Licensing (available at www.hydroreform.org/toolkit.asp) should help all participants, such as license applicants, agencies, Tribes, and citizens, satisfy the new licensing regulations of the Federal Energy Regulatory Commission. Ideally, it will be used to enhance the quality of study requests and plans, as well as the implementation of studies and resolution of disputes. The authors are recognized experts and have been involved in numerous flow studies for hydropower licensing and other water resources decisions.

The guide complements and updates an earlier NPS publication, Instream Flows for Recreation: A Handbook on Concepts and Research Methods (Whittaker et al., 1993). This new report provides more specific guidance about a phased approach and other practical aspects of conducting recreation flow assessments.

The National Park Service Hydropower Recreation Assistance program works with parties involved in licensing hydropower facilities regulated by the Federal Energy Regulatory Commission to ensure that public interests in recreation and conservation are addressed. The program draws its authority from the Federal Power Act and technical assistance provisions of the Outdoor Recreation Act of 1962, the Wild and Scenic Rivers Act of 1968, and the National Trails System Act of 1968.

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Many early flow-recreation studies focused on whitewater boating, an activity where flows have dramatic effects. Flows determine whether a river is runnable by boaters with different skills or craft, and affect the size and power of hydraulics that create interesting whitewater.

Left: Faraday Diversion Reach on Oregon's Clackamas River at 1,220 cfs.

Flow regimes have important long-term effects on a river's biophysical characteristics such as aquatic habitat, but flows also affect "fishability" or "angler habitat." Studies can define flow needs for different types of fishing opportunities.

Right: Oregon's Upper Klamath River at 350 cfs.

Introduction

Instream flow, the amount of water in a river, fundamentally affects recreation quality in most river settings. In the short term, flows determine whether a river is boatable, fishable, or swimmable, and they affect attributes such as the challenge of whitewater or the aesthetics of the "riverscape" (Brown, Taylor, & Shelby, 1991; Whittaker et al., 1993; Whittaker & Shelby, 2002). Longer term flow regimes (e.g., over a period of years) may also have effects on fish populations and other ecological resources (Bovee, 1996; Richter et al., 1997; Tharme, 2002), riparian environments (Jackson & Beschta, 1992), or channel features such as beaches, pools, and riffles (Hill et al., 1991). Many of these are critical for specific types of river recreation.

Instream flows are commonly manipulated on regulated rivers through dam releases or out-of-stream diversions; as a result, flow management has become one of the most important issues on the river conservation agenda (Stanford et al., 1996; Poff et al., 1997; Richter et al., 1997). Natural resource agencies (e.g., U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service) have been interested in assessing the impacts of flow regimes on recreation, and studies of flow-recreation relationships have become common in most Federal Energy Regulatory Commission (FERC) licensing processes (see sidebar on "Hydropower Licensing and Recreation"). Flow-recreation issues are also relevant in other river-related issues such as navigability or water rights adjudications, or during reviews of federal dam operations.

Considerable work on flow and recreation has occurred in the past two decades (Brown et al., 1991; Shelby, Brown, & Taylor, 1992; Whittaker & Shelby, 2002), and a variety of methods have been developed (see Whittaker et al., 1993 for a review). While these are effective approaches and methodological tools, applications and integration into decision-making processes have been uneven. For a variety of reasons, including varying study quality, recreation interests may have difficulty competing with other resources in regulated river decision-making.

Several reasons help explain varying study quality. First, studies have generally been designed to answer specific questions in arenas such as FERC licensing, water adjudications, or navigability proceedings. This means that few studies have been conducted as part of a systematic research program that could expand the scope of studies, encourage basic research, and link related elements across studies.

Second, studies are generally conducted by non-academic consultants or in-house utility staff. These professionals have fewer incentives to publish in the scientific literature, which limits information transfer. Informal "networking" remains the primary conduit for transmission of "knowledge" about how to conduct effective studies or integrate results.

Third, there has been limited guidance from agencies (FERC or others) about standards for conducting and using studies. This allows the quality and scope of studies to vary case-by-case depending upon the level of interest, expertise, and support from individual agencies, utilities, researchers, or advocacy organizations.

Some of these problems are systemic and challenging. However, clear standards for conducting and using studies would be a major improvement, particularly in FERC license proceedings. This paper offers a start toward that goal by recommending a conceptual perspective and a progression of study options, and then reviewing protocols, responsibilities, and products involved in those options.

Some recreation users are unaware that flows affect their activities. Careful studies can document how flows affect important conditions in "recreation habitats" such as this swimming area on California's Klamath River at 600 cfs.

Objectives

The overall goal of the paper is to summarize ideas for improving flow-recreation research and its integration into decision-making (particularly FERC processes on regulated rivers). Specific objectives are to:

- Provide a conceptual perspective that differentiates descriptive versus evaluative information.
- Develop a progression of study options, with increasing resolution provided at each level, to help identify research needs in specific situations.
- Review elements associated with study options, clarifying and standardizing terminology for methods or study outputs.
- Review common roles and responsibilities of agencies, utilities, consultants, and stakeholders.
- Identify study outputs or products needed at various stages in the progression to ensure that results can be integrated into decision-making processes.
- Discuss broader challenges in integrating recreation study results with those for power and non-power resources.
- Consider how study information is used to develop cost-effective and beneficial protection, mitigation, and enhancement measures (PMEs) to include in project licenses.

In addressing these objectives, the primary aim is to provide a common understanding of flow-recreation study issues for both researchers and "professionals" who review that research. We include researchers, consultants, and staff from interest groups, agencies, and utilities under this label, but it also extends to interested recreation users or advocates who may become involved in flow-recreation work. In order for these professionals to work together effectively, they need to be able to "speak the same language."

At the same time, we caution readers that this document does not provide all the information necessary to conduct the various study options. Quality flow-recreation studies require a range of social science and logistical skills, and experience adapting concepts and methods to specific cases. Similarly, a growing literature of technical reports may suggest examples of key study elements (e.g., question formats in a survey instrument or questionnaire), but these cannot be blindly applied. Questionnaire development is a proportionally small part of most study efforts, and the ability to tailor questions and analysis to each new case is critical. Accordingly, we have not provided example survey instruments or report findings, although these are widely available in study reports or journal articles cited in the references. Researchers interested in methodological details of various study types are urged to more closely review this literature; this document is designed for a more general audience of river professionals who might be considered the "critical consumers" of flow-recreation research.

Finally, this document focuses on studies common to FERC licensing efforts, but many of these study options are relevant in other river "decision environments" such as navigability and water rights adjudications, or reviews of federal dam operations (e.g., Corps of Engineers or Bureau of Reclamation projects). In each of these cases, the common need is to understand how flow regimes affect recreation quality or use, and then integrate that information with findings from other resource areas. Similarly, resources to study these relationships are often constrained, which puts a premium on efficient and focused studies.

Wading-based fishing is dramatically affected by flows because depths and velocities determine access to fishable water.

Below: During a flow study on California's Pit River, anglers evaluated flows from 150 to 1,800 cfs (600 cfs shown here).

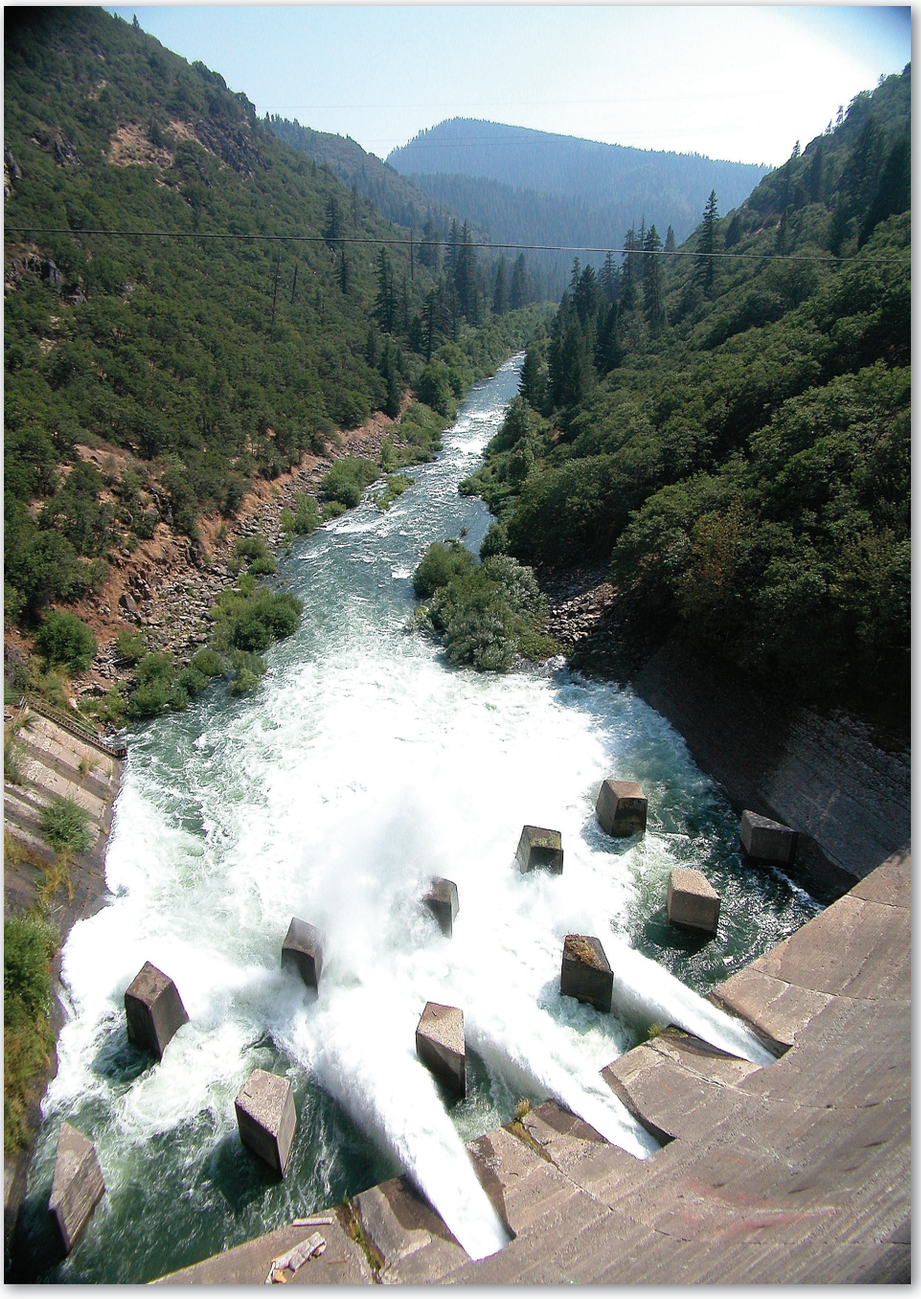
Organization

The paper is organized by sections on 1) a conceptual perspective; 2) a progression of study options; 3) a review of study options; and 4) integration, trade-offs, and inserting findings into decision-making processes.

The document also provides a series of "sidebars" interspersed through the text. These short discussions of related topics are identified by a box outline. Separate sidebars are provided on:

- Hydropower licensing and recreation
- Flow regimes, long-term effects, and recreation
- Flows and aesthetics
- Problems with "blind" flow studies
- Flows, fish habitat, and fishability
- Roles and responsibilities during fieldwork
- Study needs for new license applications

Photos illustrating key concepts or study findings are also interspersed throughout the report. Highlighting central ideas from the document, these photos and captions also convey the breadth and depth of flow-recreation studies or the issues they have addressed.



"Controlled flow studies" are a powerful tool, allowing resesarchers and recreation users to evaluate a range of flows over a short period of time. These studies are common for relicensing projects that have bypass reaches. Different study options provide different levels of resolution about flow effects on recreation; this guide helps river professionals recognize the "right tool for the job".

Left: Pit 3 Dam releases 1,800 cfs on California's Pit River; this bypass reach has historically provided base flows about 150 cfs.

Even small dams can affect hyrdaulics, riparian vegetation, and channel characteristics, which in turn affect the type and quality of recreation opportunities.

Left: This diversion dam on California's Hamilton Branch of the North Fork Feather River typically leaves base flows less than 50 cfs. This provides good fishing, but boating requires about 250 cfs. The 95 cfs release shown here was boatable on the river's upper segment, but not on the steeper lower segment.

Flows affect depths, velocities , and water quality, important attributes for swimming. Less swift flows may be better for children or less skilled swimmers, but lower flows may be too shallow or appear stagnant.

Right: Taylor Creek, a tributary to Oregon's Rogue River.

Conceptual Perspective

Assessing flows for any resource requires a conceptual framework; one option is shown in Figure 1. Flow is the variable driving the system, and it can come from natural or human-regulated sources. Flow, in turn, affects resource conditions. Immediate effects are related to hydraulics (depth, velocity, width, wetted perimeter, and turbulence), but longer-term effects occur though interactions with channel geomorphology and riparian vegetation. Taken together, hydraulics, channel morphology, and riparian vegetation form a dynamic system of resource conditions that define biophysical and recreation "habitats." Combinations of resource conditions associated with a given flow regime, in turn, provide resource outputs. Broad categories of outputs include recreation opportunities (e.g., whitewater boating, wading-based fly fishing, family swimming and wading) and biophysical resources (e.g., quality of a sport fishery, amphibian populations, beach size or abundance).

To the extent that flow regimes can be managed to produce different combinations of outputs, the final element in the framework assesses resource trade-offs. Here the framework moves from the "descriptive" arena (where scientists determine how flows affect resource conditions and outputs), to the "evaluative" arena (where decision-makers, resource managers, and interest groups consider the desirability of different combinations of outputs; Shelby and Heberlein, 1986). These evaluations are generally made in decision-making processes (such as FERC license proceedings) where social values are often central (Kennedy and Thomas 1995).

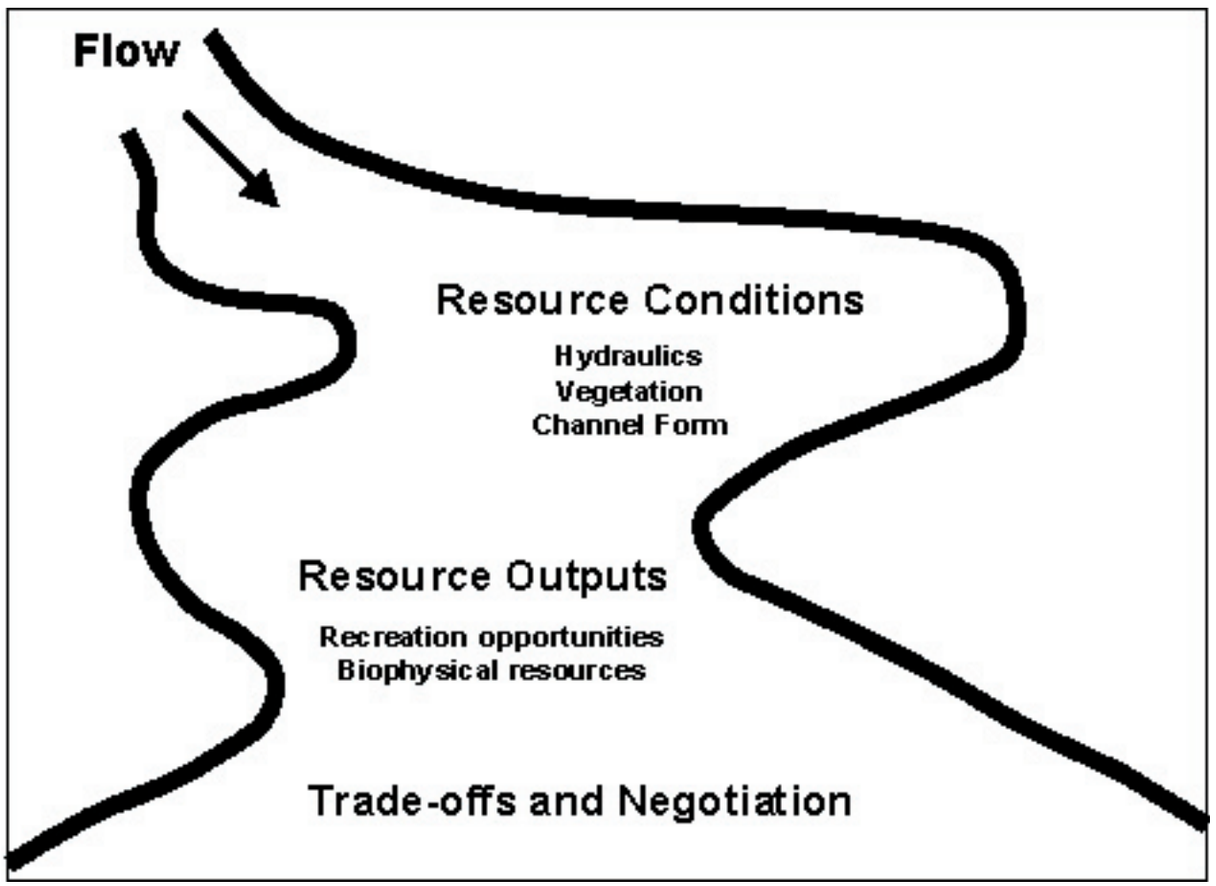


Figure 1. A framework for assessing flows for recreation or other resources.

SIDEBAR

Hydropower Licensing and Recreation

The Federal Energy Regulatory Commission regulates operating licenses for approximately 2,500 hydropower dams across the country, with most operated by private utilities or public utility districts. Licenses are usually granted for periods of 30 to 50 years; when those licenses expire, utilities must apply and receive a new license to keep operating a facility. Since 1993, FERC has issued or renewed more than 350 hydropower projects throughout the nation. Over the next decade, FERC is expected to consider licenses for an additional 200 projects.

The Electric Consumers Protection Act (ECPA, 1986) rewrote "the rules of the game" for assessing and mitigating impacts of projects, so relicensing generally requires consideration of issues that played little part in an "old" license. ECPA requires FERC to give "equal consideration to power and non-power values" when issuing hydropower licenses, so impacts on all these resources must be studied during relicensing and possibly mitigated in the new license. Reservoir and downstream river recreation qualify as "non-power values," and regulations subsequent to ECPA led to a formal role for the National Park Service to provide advice or represent recreation interests in relicensing processes. Agencies that manage land affected by hydropower projects (e.g., the U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service) have similar responsibilities to represent a variety of environmental values, including recreation.

Licensing processes are complex, multi-year resource planning and decision-making efforts that generally have three major phases, although these are handled in slightly different ways depending upon whether a "traditional" (TLP), "alternative" (ALP), or "integrated" (ILP) process is being used. Until 2004, licensees chose between traditional and alternative processes (and several of these processes are on-going and "grandfathered" in), but since that time the ILP is the "default" process (although licensees can still request to use the TLP or ALP).

The first phase involves assembling existing information about the project and potentially affected resources. This helps identify information gaps that will lead to discussions about which studies should be conducted to assess impacts for alternative operation or mitigation scenarios. With traditional or alternative processes, a "first stage consultation package" was the end point in this effort. With the ILP (and all future TLP or ALP efforts), a "preliminary application document" (PAD) is the corresponding product, and it is guided by the standard of "existing, relevant, and reasonably available information."

The second phase focuses on developing study plans, completing the studies, and integrating findings across resource areas. In traditional and alternative processes, this is usually a two- to three-year effort that culminates in draft and final license applications from the utility. In some cases, settlement discussions between utilities, agencies and stakeholders may also be a part of this phase. Most of studies described in the present document typically occur during this phase.

The third phase focuses on resolving conflicts between the utility, agencies, and stakeholders through an impact analysis conducted by FERC through a National Environmental Policy Act (NEPA) planning process. NEPA planning requires developing a range of reasonable alternatives, assessing environmental impacts for each, public involvement, and decision-making by an interdisciplinary team. In traditional and collaborative FERC processes, scoping, alternatives, and impact analyses generally evolved from studies in the second phase. In the ILP, scoping for the NEPA track starts when the PAD is released and studies are developed, but alternative development and impact analysis still typically occur after studies are completed.

The final result of a NEPA-based decision is a license to build and/or operate a project with "articles" that prescribe operations and mitigation. When settlements between utilities, agencies, and stakeholders occur, FERC generally incorporates them into the NEPA process and final license.

Detailed comparisons between these licensing processes are beyond the scope of this document, but a few other differences between the license processes are notable. With a **traditional licensing process**, utilities generally retain greater control over the contents of draft and final license applications, although there are specific consultation requirements to encourage consideration of stakeholder or agency concerns and sometimes a more collaborative hybrid process is used. When disputes arise FERC is responsible for resolving them, but this generally occurs later in the process.

With an **alternative licensing process**, utilities, stakeholders, and agencies are encouraged to develop study plans and applications in a more collaborative fashion, hopefully increasing efficiency and avoiding some of the later-stage disputes common in traditional approaches. However, collaboration can be time-consuming and labor-intensive, and consensus may still be difficult (requiring FERC dispute resolution).

The recently-developed **integrated licensing process** is an attempt to address some of these deficiencies. The ILP prescribes earlier FERC participation, more formalized agency and stakeholder collaboration or consultation roles, and an accelerated schedule that includes concurrent NEPA issue

FERC will "relicense" about 200 hydropower projects over the next decade, and many of these will affect recreation. FERC rules require utilities to assemble existing recreation information, develop study plans, conduct studies, and discuss findings with stakeholders. These efforts provide excellent opprotunities for research and planning that result in "on-the-ground" actions. Above: Release from Faraday Diversion Dam on Oregon's Clackamas River during a controlled flow study.

scoping while studies and the license application are being developed. The ILP also creates a formal process for addressing conflicts about studies requested to provide information for potential mandatory conditioning of licenses by federal and state agencies, or Tribes. This formal process includes participation from an "outside" expert for the resource area in question.

ILP regulations prescribe rigorous justifications for studies and earlier, binding approval of studies by FERC. The goal is to minimize "additional information requests" (by agencies or stakeholders) and help licensing processes stay on a tighter schedule. Study requests must include: (a) study goals and objectives; (b) resource management goals or public interest considerations; (c) existing information and the need for more information; (d) the connection between project operations, resource effects, and potential license requirements; (e) study methods consistent with generally accepted practice; (f) an assessment of study effort and costs; and (g) reasons whys the applicant's proposed studies would not be sufficient. It is premature to assess how well this new process will work.

With all processes, agencies and stakeholders have general responsibilities to help identify recreation issues; determine study needs; assist with study design, conduct, or evaluation; help integrate study results into application proposals; and facilitate settlements between agencies, utilities, and stakeholder groups. The present document is designed to help clarify those roles and responsibilities

A Progression of Study Options

Deciding upon the appropriate "degree of resolution" is a major issue in flow-recreation studies. Some rivers have extensive recreation use that is clearly flow-dependent and affected by project operations; here more intensive and detailed efforts are necessary. On other rivers, the potential for a recreation use may be unknown (e.g., whitewater boating on a bypass reach, fishing for a species that could be reintroduced), or the use may be only marginally affected by flows that the project does not substantially affect. In these cases, less intensive studies may be required.

Given the potential diversity of situations, it is difficult to specify a single set of standards for a "sufficient" study. Instead, we recommend a progressive approach with "phased" efforts of increasing resolution. All studies have to provide similar initial information about recreation opportunities, their likely dependency on flows, and potential project effects. However, more intensive or detailed studies will only be prescribed in situations that merit them. To be effective, this approach needs 1) a clear sequential framework; 2) standardized terminology for various study options; 3) agreement about which study options provide which degree of resolution; and 4) explicit decision criteria to help determine whether the study needs to continue to the next level.

The following framework suggests three levels of resolution, with distinct study options generally linked to each level:

• **Level 1** – "desk-top" options: This is the initial information collection and integration phase. It usually focuses on "desk-top" methods using existing information, or limited interviews with people familiar with flows and recreation on the reach.

• **Level 2** – limited reconnaissance options: This increases the degree of resolution through limited reconnaissance-based studies, more intensive analysis of existing information, or more extensive interviews.

• **Level 3** – intensive studies: This substantially increases the degree of resolution through more intensive studies, which may include multiple flow reconnaissance, flow comparison surveys, or controlled flow studies.

This framework has been applied successfully in FERC relicensing proceedings, and it has the potential to improve studies or applications in several ways. First, it focuses resources on those river reaches with greater interest to the recreation community or with greater impacts from project operations, while reducing workloads on reaches with less interest and lesser project effects. This streamlines costs by prioritizing reaches more "deserving" of additional study. This is especially useful at hydropower projects with multiple dams, powerhouses, and river reaches, where prioritization and efficiency are particularly important.

Second, it provides a transparent and defensible record for all entities (e.g, Licensees, stakeholder groups, and agencies) regarding the "sufficiency" of effort. This should lead to more efficient licensing or adjudication proceedings, and limit challenges.

Third, it helps standardize methodologies and improves comparability across situations. This should improve the quality of study products and allow them to be more efficiently used in license proceedings or other decision-settings.

Fourth, the increased transparency of the phased approach allows information to be shared earlier in the process, particularly across resources. This allows an earlier discussion of potential conflicts between flow needs for different resources, which may help researchers design studies that address solutions to those conflicts. Integrating information across resources is a major challenge in licensing proceedings; the earlier potential conflicts are articulated, the more likely researchers can provide information about trade-offs or potential ways to address them.

Finally, there are efficiencies in conducting coordinated studies, particularly if controlled flow releases are part of the study design. Although it is beyond the scope of this report, there appear to be similar benefits of using a progressive approach with aesthetics, fisheries, or other resource studies, with parallel types of work at the desk-top, initial reconnaissance, and intensive study levels. Formally recognizing these levels and coordinating study needs can help reduce the costs of studies and encourage inter-disciplinary exchanges throughout the study process.

The remainder of this guide reviews elements for each study option, including 1) objectives; 2) typical approaches; 3) products; 4) typical responsibilities of agencies, utilities, and advocacy groups; 5) "additional issues" to highlight challenging tasks or suggest protocols that characterize more successful efforts; and 6) "cautions or limitations" that may restrict use of an option or require additional information from other study options.